



UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/212,726 12/15/98 SCHUEGRAF

K M122-1098

EXAMINER

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ART UNIT

PAPER NUMBER

2813

DATE MAILED:

14
10/10/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.
09/212,726

Applicant(s)
Schuegraf

Examiner
Erik Kielin

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Aug 27, 2001
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 39-41 and 44-52 is/are pending in the application.
- 4a) Of the above, claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 39-41 and 44-52 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- a) ☐ All b) ☐ Some* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- *See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

- 15) ☐ Notice of References Cited (PTO-892)
- 16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 17) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). 2
- 18) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 19) ☐ Notice of Informal Patent Application (PTO-152)
- 20) ☐ Other: _____

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DETAILED ACTION

Drawings

At Applicant's request, Examiner is hereby notifying Applicant that the draftsperson has already approved the drawing. This is the reason that no objections by the draftsperson were indicated in the previous actions.

Information Disclosure Statement

1. The information disclosure statement filed 12/15/98 fails to comply with 37 CFR 1.98(a)(3) because it does not include a concise explanation of the relevance, as it is presently understood by the individual designated in 37 CFR 1.56(c) most knowledgeable about the content of the information, of each patent listed that is not in the English language. It has been placed in the application file, but the information referred to therein has not been considered.

Claim Rejections - 35 USC § 112

Amendment to the claims to remove the requirement for the unsubstantiated reduction in the decomposition rate of the organosilicon precursor

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

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3. Claims 48 and 52 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claim 48 requires "conditions which are effective to... reduce the theoretical decomposition rate [of the organic silicon precursor] to a lower actual decomposition rate." In short, addition of H_2O or H_2O_2 speed up rather than decrease the decomposition rate of the organic silicon precursor -- not reduce it.

Examiner respectfully submits that the only provision for reducing the decomposition rate provided in the specification is an *incorrect* application of Le Chatelier's Principle which can be found beginning on page 9, line 20. The information regarding the theory is incorrect for at least the following reasons: (1) The organic silicon precursor is *not in equilibrium* with the at least one of H_2O or H_2O_2 because both intermediate and product compounds of silicon are being removed from the system by deposition onto the substrate which, according to the aforementioned theory, *speeds up rather than reduces* the decomposition of the precursor. (See, for example, Applicant's admitted prior art article by IslamRaja et al., page 722, last paragraph, right-hand column.) (2) There is *no reverse reaction*, so an equilibrium cannot exist. Instead, each of the organic silicon precursors claimed by Applicant can only produce H_2O by reaction of the organic portion only, the reverse reaction is thermodynamically prohibited under the conditions presented by Applicant. (3) Assuming *arguendo* that H_2O or H_2O_2 were somehow in equilibrium with the

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organic silicon precursor, as both a reactant and a product, H_2O or H_2O_2 would tend to cancel each other out in effect of shifting equilibrium. As more H_2O (or H_2O_2) would be produced, more reactant and product would be introduced which would tend to cancel in effect to a degree determined by the stoichiometry of the reaction. Without a specific precursor, it is impossible to determine such stoichiometry and therefore impossible to determine the alleged degree of reduction -- again assuming *arguendo* such equilibrium exists.

Examiner acknowledges the well known fact that H_2O (or H_2O_2) is a product of the *net* or *global* reaction in the decomposition of the organic silicon precursors (IslamRaja et al. page 722, equation (1) and paragraph thereafter) but H_2O (or H_2O_2) is **not** in equilibrium with the precursor and therefore cannot reduce the rate as alleged by Applicant in the specification. Consequently one of ordinary skill would find either *no change* in the decomposition rate or more likely an *increase* in decomposition rate of the organic silicon precursor as found, for example, by Sukharev (US 5,710,079; column 3, line 66 to column 4, line 13) for tetraethylorthosilicate (TEOS). Absent evidence to the contrary, the method as claimed would not operate as alleged.

Since Applicant indicates that they have observed a decrease in the rate (Remarks section of Paper No. 7, page 4, lines 9-10), **Applicant could overcome the rejection simply by providing a signed affidavit with the appropriate experimental data showing such decrease in rate in fact occurs.** This should not provide a burden since Applicant indicates that such data already exists. This evidence is necessary since the preponderance of evidence (all of the evidence) indicates that (1) Applicant's theory regarding the decomposition rate is flawed and (2)

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addition of water and hydrogen peroxide *increase* rather than decrease the decomposition rate of TEOS. See section entitled, “*Response to Arguments*” for further reasoning.

4. Claims 39-41, 44-46 and 47 and 48-52 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Each of the independent claims, 39, 47, and 48 were amended to include the limitation of, the additional quantity [of gaseous oxide of hydrogen] comprising at least about 5% by volume of the material fed into the reactor. There is no basis for this limitation. See specification page 10 and page 12. On page 10 the upper limit of H₂O or H₂O₂ appears to be 15%. On page 12 the upper limit appears to be 50% so there appears to be no basis for “at least about 5%.”

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 39-41, 44-46 and 47, 49-51 and 48, 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Sukharev** (US 5,710,079).

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Sukharev discloses a method of depositing SiO_2 on a substrate using a $\text{H}_2\text{O}/\text{H}_2\text{O}_2$ CVD process in which an organic silicon precursor (for example, TEOS, and others as in claim 7) and H_2O and/or H_2O_2 are fed separately into a CVD reactor (column 5, lines 55-65) in a concentration of 0.5 to 6 percent (column 7, last paragraph). The H_2O may be introduced without H_2O_2 (col. 6, ln. 55). (See also columns 3-7; Figs 2-3.)

Because the concentration range indicated by Applicant in the specification provide conditions “which are effective to reduce formation of undesired reaction intermediates” (see specification page 12, lines 3-13) and overlap those in **Sukharev**, the method of **Sukharev** must inherently reduce the formation of undesired reaction intermediates. See In re Swinhart, 169 USPQ 226,229 (CCPA 1971) (where the Patent Office has reason to believe that a functional limitation asserted to be critical for establishing novelty in the claimed subject matter may, in fact, be an inherent characteristic of the prior art, it possesses the authority to require the applicant to prove that subject matter shown to be in the prior art does not possess the characteristics relied on) and In re Fitzgerald, 205 USPQ 594 (CCPA 1980) (the burden of proof can be shifted to the applicant to show that subject matter of the prior art does not possess the characteristic relied on whether the rejection is based on inherency under 35 USC 102 or obviousness under 35 USC 103).

Although **Sukharev** does not specifically indicate that the presence of H_2O and/or H_2O_2 decreases undesired reaction intermediates, **Sukharev** does indicate that the growing SiO_2 film has reduced carbon resulting which is an intermediate in the decomposition of the organic

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moieties of TEOS. It is held, absent evidence to the contrary, that the method of **Sukharev** will inherently reduce the presence of unwanted reaction intermediates.

Regarding claim 41, the prior art as explained above discloses all of the limitations of the instant invention, but does not teach Applicant's concentration range of 5-15%. Instead, **Sukharev** discloses ranges of 0.5 to 3% H₂O and 0-3% H₂O₂. However, it has been held that choosing parameters within or near ranges taught by the prior art is *prima facie* obvious. See *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). Therefore, it would have been obvious to choose a concentration with Applicant's range because Sukharev discloses the overlapping range of a combination of H₂O and H₂O₂ of 0.5-6%, according to the precedent set by *In re Wertheim* or *In re Huang*.

Further in this regard, since Applicant clearly teaches that any amount of water less than 50% down to less than 0.5% (specification page 10 and page 12) is sufficient to attain Applicant's observed reduction in undesired reaction intermediates, it is unclear how 5% to 15% could produce unexpected results. Nonetheless, no evidence has been provided by Applicant.

Regarding the apparatus limitations --specifically the type of reaction chamber in which the deposition is carried out-- if it is thought that the apparatus limitations have patentable weight, then this may be a difference. But it has been held that to be entitled to weight in method claims,

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the recited structure limitations therein must affect the method in a manipulative sense, and not amount to the mere claiming of a use of a particular structure. *Ex parte Pfeiffer*, 1962, C.D. 408 (1961). In this regard then, the carrying out of the deposition in a low-pressure, hot-wall, cold-wall, or combinations thereof, CVD chamber, has no patentable weight in the method claims because none are manipulative of the method.

If Applicant is concerned with using low pressures, and hot or cold walled CVD chambers then Applicant must claim such pressures and temperatures and not merely infer that they are being used simply because the adjectives describing the chamber have been amended. No new matter may be added. Interestingly, as originally claimed, the deposition pressure and the temperature of the CVD chamber wall apparently did not have a bearing on the reaction rate since no deposition pressures in the CVD chamber were originally claimed.

7. Claims **39-41**, **44-46** and **47**, **49-51** and **48**, **52** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Sukharev** in view of **Wolf** (Silicon Processing for the VLSI Era, Vol. 1).

Assuming *arguendo*, that the apparatus limitations are entitled to patentable weight, which they are not believed to by Examiner, the prior art as explained above in paragraph 8 discloses all of the limitations of claims except for specifically indicating that the CVD reactor is a hot wall (claim 45) or a "cold hot" reactor (claim 46) or using a hot-wall, low-pressure CVD reactor (claim 48) to deposit the silicon oxide film.

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The prior art as explained above in paragraph 8 discloses all of the limitations of claims of the claimed invention except for specifically indicating that the CVD reactor is a hot wall (claim 45) or a “cold hot” reactor (claim 46) or using a hot-wall, low-pressure CVD reactor (claim 48) to deposit the silicon oxide film.

However, **Wolf** teaches that hot-wall, **low-pressure** CVD reactors are the most widely used reactors and are employed for depositing silicon oxide films because of their superior economy, throughput, uniformity, and ability to accommodate large diameter wafers on page 169, last 8 lines). **Wolf** also teaches the benefits of using cold wall reactors on page 171, first paragraph.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teachings of **Wolf** to the **Sukharev** reference for the reasons given by **Wolf**.

Response to Arguments

8. Applicant's arguments filed 8/27/01 have been fully considered but they are not persuasive.

Applicant argues that because **Sukharev** uses different pressure conditions for the CVD that Sukharev cannot be used to indicate that H_2O or H_2O_2 cannot be used as evidence of a rate increase. Examiner expressly disagrees. First, Applicant has claimed no pressure for the reaction. Applicant merely claims that the deposition is carried out in a low-pressure CVD chamber. As indicated above, **apparatus limitations do not have patentable weight in the method claims** if

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such limitations are manipulative of the invention. Furthermore, the only difference between an LPCVD apparatus and an APCVD apparatus is the use of a vacuum system to reduce the pressure. The *chambers* themselves can be identical. It does not make sense that one of ordinary skill would pay huge sums of money to build separate APCVD and LPCVD apparatus when all that one would need to do to carry out CVD at any pressure is to install a by-pass valve upstream of the vacuum system thereby allowing bypassing of the vacuum system and enabling atmospheric pressure deposition to be used. Again it is not remarkable that the deposition is merely carried out in a given chamber. If pressure count then pressure must be claimed.

Second, assuming arguendo, that Applicant's have somehow claimed a deposition pressure merely by amending the claims to recite the name of the chamber, **Sukharev** only indicates that the reaction is "[p]referably... carried out at atmospheric pressure" (column 3, lines 63-65). He does not say that the rate increase due to the presence of the intentionally generated hydroxy groups will not occur if the deposition pressure is reduced. And, again, **Applicant has claimed no pressure.**

Third, and most importantly, Applicant indicates in the specification, at least at page 12 that amounts of water or hydrogen peroxide which are less than 50% down to less than 0.5% will all show the alleged decrease in decomposition rate of the organosilicon compound. It is wholly improper to say is no longer indicative of a decrease in the decomposition rate of the organosilicon compound when **Applicant's specification has clearly disclosed that the range in Sukharev is within the appropriate range to create a decreased decomposition rate.** That

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the claim reciting the percentage range (claim 42) which was covered by Sukharev is now canceled neither supersedes nor circumvents Applicant's admissions in the specification.

It is held that Applicant's arguments concerning the alleged unexpected results are merely conclusory observations of Applicant's Representative in the absence clear and convincing evidence provided in an appropriately filed affidavit, signed by the inventors.

For at least these reasons, Applicant's arguments regarding the rejection under 35 USC 112(1) and there application to the prior art rejections are not found persuasive. Again, **Applicant is requested to provide evidence since Applicant has indicated that such evidence exists.**

Applicant argues that Examiner has failed to provide "a reasonable argument regarding inherency." Examiner respectfully disagrees and directs Applicant to the arguments provided in the previous office action (Paper No.8, filed 10/30/00) under the section the entitled "***Response to Arguments***" (emphasis original) which were conveniently ignored by Applicant in the present response. The entirety of such arguments are incorporated herein. In short salient summary, Applicant argues that because Sukharev uses UV radiation plus ozone plus water or, alternatively, hydrogen peroxide plus water plus UV radiation, that Applicant's method is somehow different. But as previously indicated by Examiner, Applicant's method uses a thermal process or, alternatively, H_2O plus O_2 in a *plasma* CVD method **both of which necessarily produce hydroxyl radicals**, as indicated by the supporting references provided earlier. Therefore, Applicant's reaction mixture shares the same rate accelerating hydroxyl radicals, as in that of

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Sukharev, no matter the method by which the hydroxyl radicals are produced. Therefore, if Applicant is seeing a decrease in the production of undesired reactive intermediates due to an alleged decrease decomposition rate of TEOS, then so must **Sukharev** because the reaction mixtures contain the same reactive intermediates.

Applicant continues to argue that Examiner's assessment of the theory is incorrect. Examiner expressly disagrees for the reasons indicated above and for reasons indicated during the course of the telephone interview. Applicant has still failed to provide evidence that the decomposition rate of the organic silicon precursor would show a decreased rate of decomposition under the conditions provided in the specification. Again, the overwhelming majority (all, as a matter of fact,) of the evidence presently of record indicates that the oxides of hydrogen (H_2O and H_2O_2) increase rather than decrease the decomposition rate of organic silicon precursors.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Homma (US 5,334,552; column 6, lines 21-68) and **Kubo et al.** (US 5,840,631) each anticipate at least the independent claims of the instant invention.

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10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

11. Any inquiry concerning this communication from examiner should be directed to Erik Kielin whose telephone number is (703) 306-5980 and e-mail address is erik.kielin@uspto.gov. The examiner can normally be reached by telephone on Monday through Thursday 9:00 AM until 7:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Bowers, can be reached at (703) 308-2417 or by e-mail at charles.bowers@uspto.gov. The fax phone number for the group is (703) 308-7722 or -7724.


EK

October 8, 2001


Charles BOWERS
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